

Optimal spatial layout of low-impact development practices based on SUSTAIN and NSGA-II

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ABSTRACT

The optimal spatial layout of low-impact development (LID) practices is the foundation and core of sponge city construction. Suitable LID facilities are selected in accordance with evaluation indices, such as runoff control, ecological benefit, stability, and cost. In this work, a system for urban stormwater treatment and analysis integration model is designed using a geographic information system. This model is solved using the non-dominated sorting genetic algorithm II to obtain a cost-effectiveness curve and an optimal spatial layout scheme. Results show that the reduction rates of rainwater runoff from LID facilities are 95% and 91% in the southern and northern watersheds, respectively, of the Huaiyuan campus of Ningxia University, Yinchuan, China. The construction costs are US\$ 2.8 million and US\$ 10.9 million in the southern and northern watersheds, respectively. This study is significant for reducing the risk of urban waterlogging, constructing urban ecological security patterns, and optimally allocating LID facilities.

Keywords: SUSTAIN; Low-impact development; Optimal spatial layout; NSGA-II; Geographic information system

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